Carotene from Vegetable Leaf Wastes Compared with Vitamin A in Laying Rations[1]

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EVERY year in the United States several million tons of vegetable leaves, stems, tops, trimmings and vines go to waste on farms and in processing plants. The Eastern Regional Research Laboratory operated by the U. S. D. A. Bureau of Agricultural and Industrial Chemistry has for several years been studying the nutritive content of vegetable wastes and methods of preparation. In cooperation with the Delaware Agricultural Experiment Station several studies have been made to determine ways of utilizing the vegetable waste products in poultry rations.

Tomhave and co-workers (1944) pointed out that dried vegetable wastes make excellent poultry feed, and when properly prepared are equal to or superior to alfalfa leaf meal. Certain of these vegetable leaf wastes are particularly good as a source of pro-vitamin A or carotene. Skoglund and co-workers (1947) indicated that carotene from dehydrated vegetable waste, either in the form of the vegetable waste meal or as a concentrate, is just as efficient as vitamin A esters from fish liver oil in sustaining chick growth.

To determine more fully the value of carotene from dehydrated vegetable wastes, it was deemed advisable to study its efficiency in laying mashes.

EXPERIMENTAL PROCEDURE

Four groups of 52 Barred Plymouth Rock Pullets each and two groups of 40 White Plymouth Rock pullets each were housed in 10′×20′ pens on September 15, 1947. The birds were hatched March 26, 1947 from eggs produced in the breeding pens on the University of Delaware Poultry Plant. The feeding and management of all birds was identical during the brooding and rearing period and only healthy sexually mature birds were selected for the various pens. All pens received artificial illumination when necessary in order to provide a fourteen hour day. A basal ration deficient in Vitamin A was formulated and is presented in Table 1.

To the basal ration were added carotene concentrate and distilled vitamin A esters containing 200,000 I. U. vitamin A per gram. The carotene concentration expressed as micrograms per pound was converted to I. U. per pound by multiplying by the factor 1.67. The carotene concentrate was pre-

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pared in a manner similar to that described in a previous paper, Skoglund and coworkers (1947). In this experiment the tocopherol and sterol fractions were removed in the molecular still and the carotene was retained in the residual oil. This oil was then mixed with bran to form a concentrated premix containing 400,000 I. U. per pound. During the fall and winter, the pre-mix was prepared monthly and added to the basal mash to provide 2,000 I. U. per pound of mixed feed. In late spring and summer the pre-mix was kept in cold storage and added to the basal mash at biweekly intervals. The distilled vitamin A esters were handled in the same manner. In this way losses of carotene and vitamin A were minimized during the warm months. Each pen was given sufficient carotene concentrate or vitamin A to provide 2,000 I. U. of vitamin A per pound of mixed feed. A conversion factor of 1 unit of carotene being equivalent to 0.6 of vitamin A was used. Since no apparent advantage was gained by the addition of tocopherol in the 1947 feeding trials, it was omitted in this experiment. The pen number, breed and ration fed are as listed in Table II.

TABLE I.—*Composition of Basal Ration*

Ingredients	Pounds
Ground white cornmeal	686
Wheat Bran	200
Wheat flour middlings	300
Ground oats	300
Meat scraps (50% protein)	100
Menhaden fish meal	50
Soybean oil meal	185
Dried buttermilk	100
Oyster shell	35
Steamed bone meal	25
Salt	10
Riboflavin concentrate	7.5
D-activated animal sterol	1.5
Manganese sulphate	.25
	2,000.25

TABLE II.—*Summary of results—carotene versus vitamin A in laying rations*

Pen No.	2 E	2 W	3 E	3 W	4 E	4 W
Breed	White Ply. Rocks	White Ply. Rocks	Barred Ply. Rocks	Barred Ply. Rocks	Barred Ply. Rocks	Barred Ply. Rocks
Supplement	Carotene Concentrate	Vit. A esters	Carotene Concentrate	Vit. A esters	Carotene Concentrate	Vit. A esters
No. Birds at Start	41	39	52	52	52	52
Length of Experiment	9½ Months	9½ Months	10½ Months	10½ Months	10½ Months	10½ Months
Eggs Per Bird	97.84	100.59	128.50	127.65	117.29	135.02
Feed Per Bird (lbs.)	81.52	83.17	89.71	86.51	87.72	93.77
Percent Mortality	36.59	35.90	34.62	25.00	32.69	32.69
Hatchability Record (3 Hatches) No. Eggs Set	—	—	370	384	419	373
Percent Fertility	—	—	90.81	86.46	86.63	90.35
Percent Hatch Fertile Eggs	—	—	88.69	88.25	81.27	79.82
Percent Hatch Total Eggs	—	—	80.54	76.30	70.41	72.12

RESULTS

Data were obtained on egg production, hatchability, feed consumption and mortality. The general summary is presented in Table II.

EGG PRODUCTION

There is a trend for the vitamin A pens to be superior to the carotene pens in egg production but the difference is relatively small in most cases. For example, in the White Rocks the vitamin A pen averaged only 2.75 eggs more per bird than the carotene pen. In the Barred Rocks, one of the vitamin A pens was highest averaging 135.02 eggs followed by one of the carotene pens with 128.50 eggs, the other vitamin A pen with 127.65 eggs and finally the second carotene pen with 117.29 eggs.

FEED CONSUMPTION

The pens with the highest egg production consumed the most feed regardless of the feed supplement used. In the White Rocks only 1.65 pounds more feed per bird was consumed by the vitamin A pen, and in the Barred Rocks with the exception of one of the vitamin A pens, which was high in consumption, only 3.20 pounds per bird separates the other three pens.

MORTALITY

Due to the fact that no culling was practiced during the trial and also the occurrence of a severe attack of newcastle disease, the mortality rate was fairly high in all pens. Only 0.69 percent separated the two White Rock pens. In the Barred Rocks a vitamin A pen had the lowest mortality, 25.00 percent, while a carotene pen had the highest, 34.62 percent. The other two Barred Rock pens had exactly the same mortality, 32.69 percent.

HATCHABILITY

Since vitamin A or carotene is essential for good hatchability, three hatches were obtained from each Barred Rock pen during the year. One of the carotene pens had the highest hatchability of fertile eggs recorded, 88.69 percent, followed by a vitamin A pen with 88.25 percent. The other carotene pen had a record of 81.27 percent and the second vitamin A pen averaged 79.82 percent.

CONCLUSION

In most cases carotene from dehydrated vegetable waste in the form of a concentrate is just as efficient as vitamin A esters from fish liver oil in maintaining egg production, feed consumption, and hatchability in laying pullets.

REFERENCES

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